The State of Electric Power in the South

Georgia Institute of Technology

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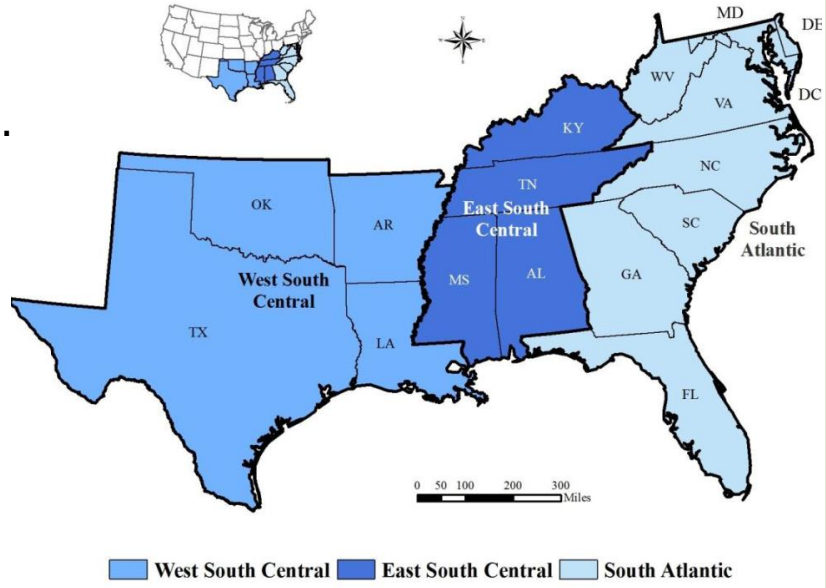
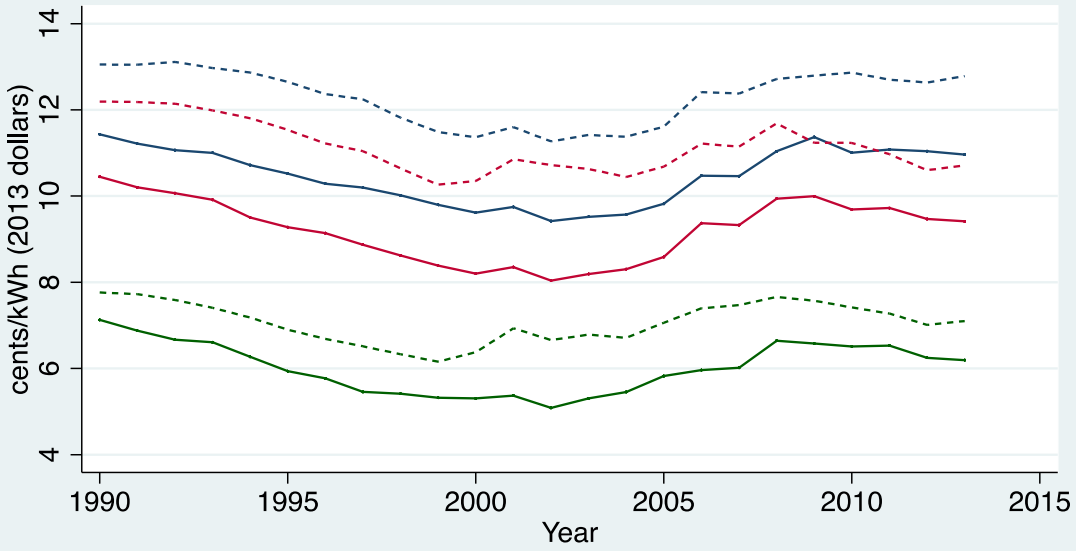


The South Benefits from Low Electricity Rates*



Prices are a sales-weighted average of state prices.
Source: EIA Form 826 and authors' calculations

- Historically residential, commercial, and industrial electricity rates in the South have been substantially below the rest of the country.

- Affordable electricity has promoted the region's economic development.

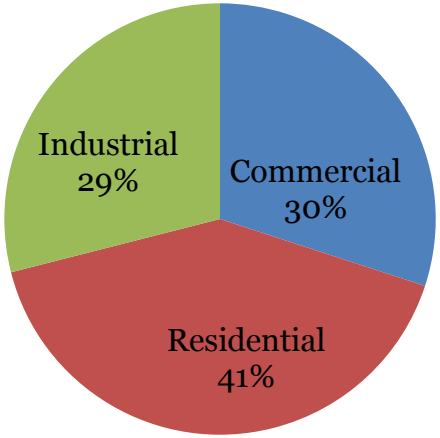
*Excludes Texas and Oklahoma

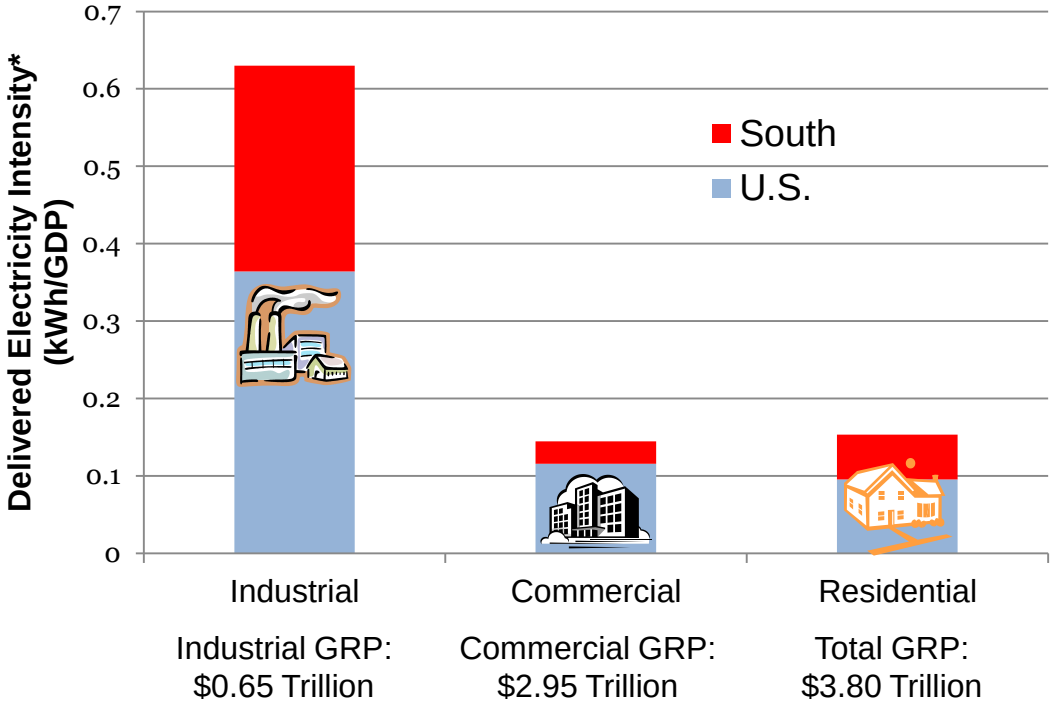
Energy Efficiency Opportunities are Large in Every Sector of the South

The Southeast accounts for:	But only:
34-43% of national energy consumption	28-36% of the U.S. population
33-43% of national electricity consumption	25-35% of the U.S. GDP

Note: ranges are without and with TX and OK.

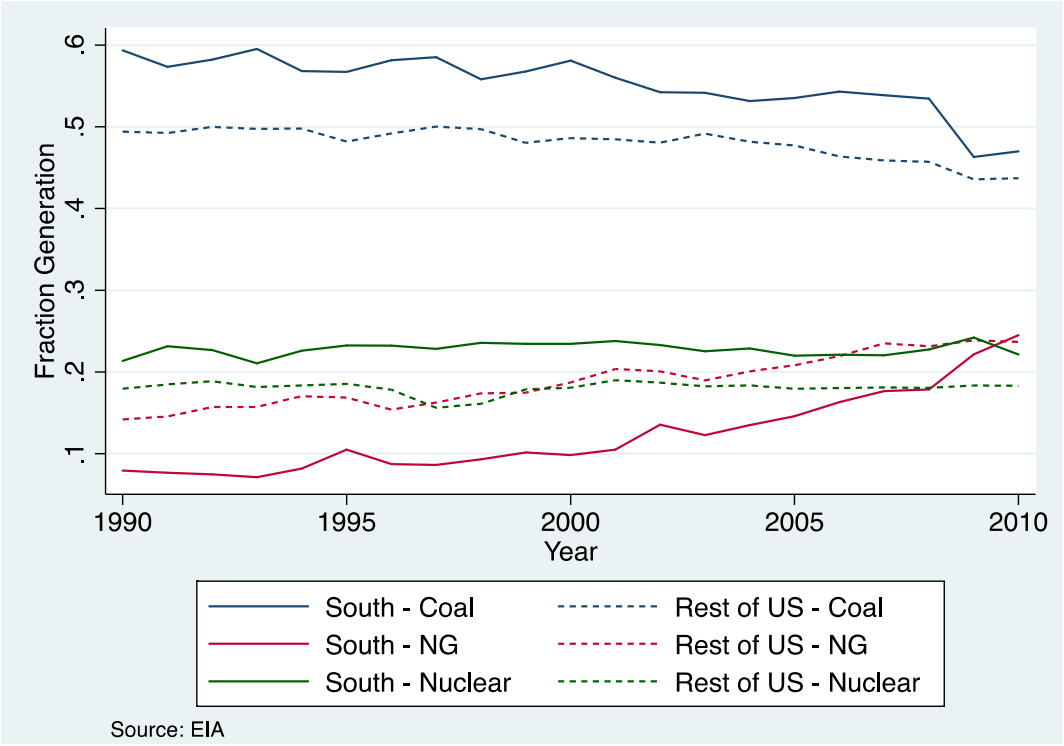
Delivered Electricity Consumption in the South in 2011 (1.42 Trillion kWh)*



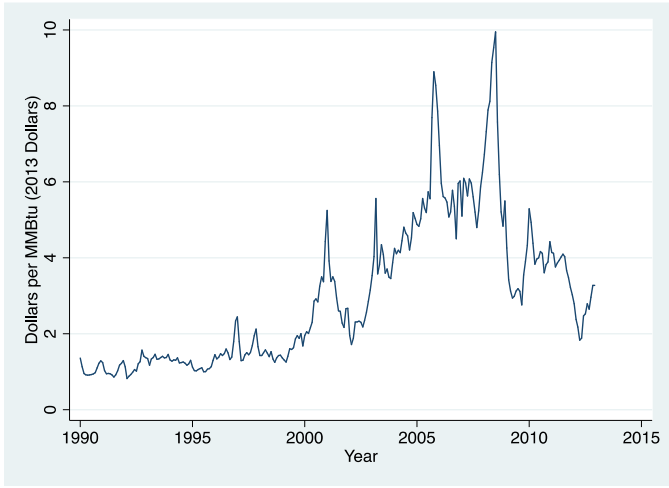


*Excludes TX and OK. Sources of data for 2012-2013: GT-NEMS; EIA Annual Energy Outlook 2013; Bureau of Economic Analysis.

Electricity in the South is Coal-Dominated, But Natural Gas is Expanding Rapidly



Source: EIA



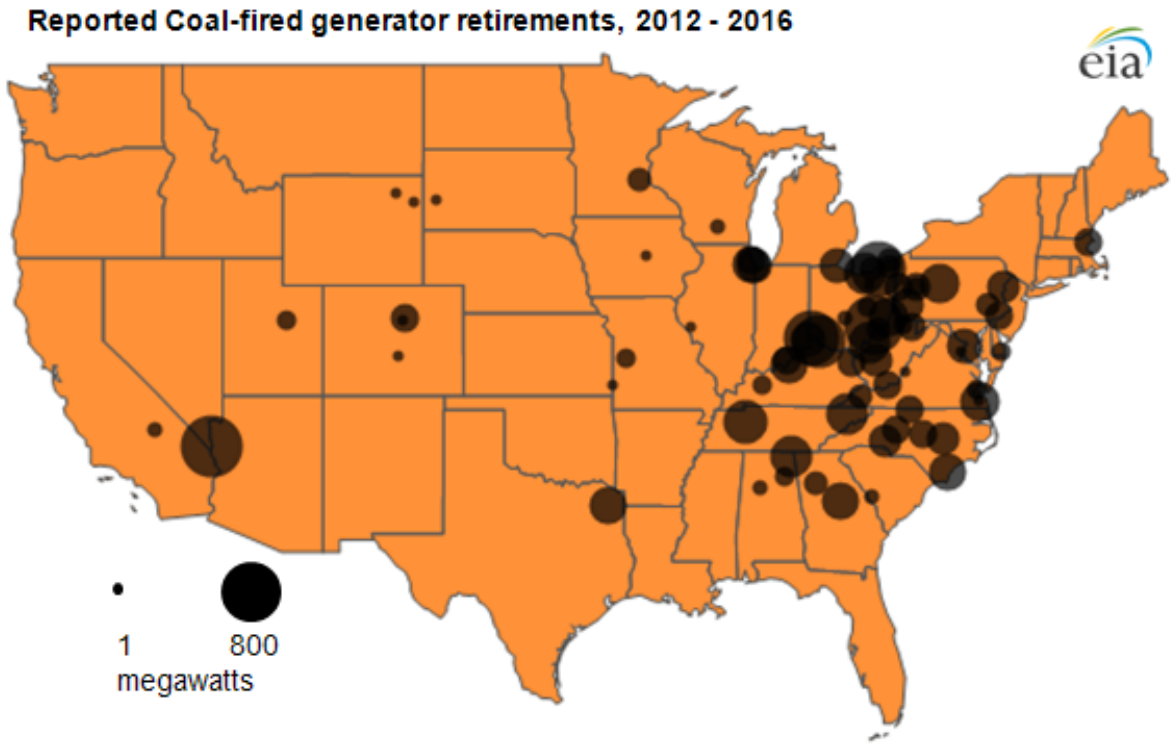
Natural Gas Prices

- This national trend is more pronounced in the South due to its gas pipeline infrastructure and historic reliance on coal.
- The South contains the only new nuclear construction in the country: Plant Vogtle in Georgia, V.C. Summer in South Carolina, and Watts Bar in Tennessee.

*Excludes Texas and Oklahoma

Accelerated Retirement of Coal-Fired Generators

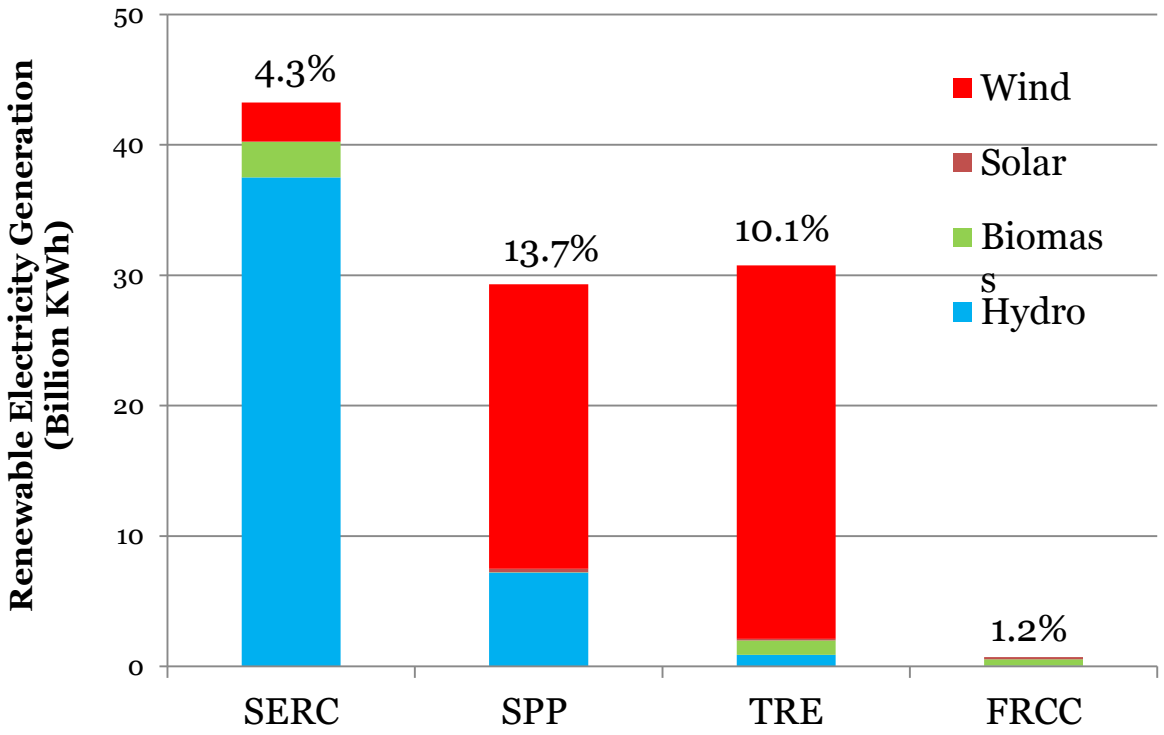
Increasing coal plant operating costs, declining natural gas prices, declining revenues, and slow growth of electricity demand are all contributors.



Note: Capacity values represent net summer capacity.

Source: U.S. Energy Information Administration, Form EIA-860, Annual Electric Generator Report,"
http://www.eia.gov/todayinenergy/detail.cfm?id=7290

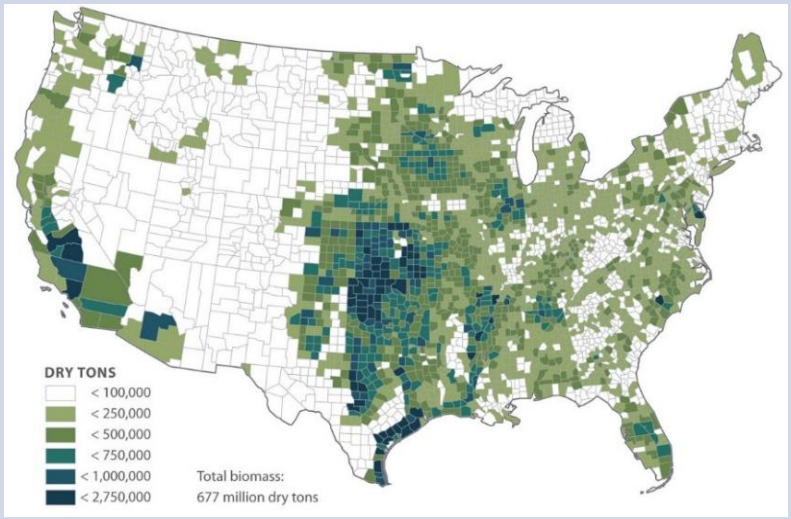
Few Southern States have Strong Renewable Policies or Large Renewable Portfolios



Sources: GT NEMS, 2013; U.S. Energy Information Administration, 2013

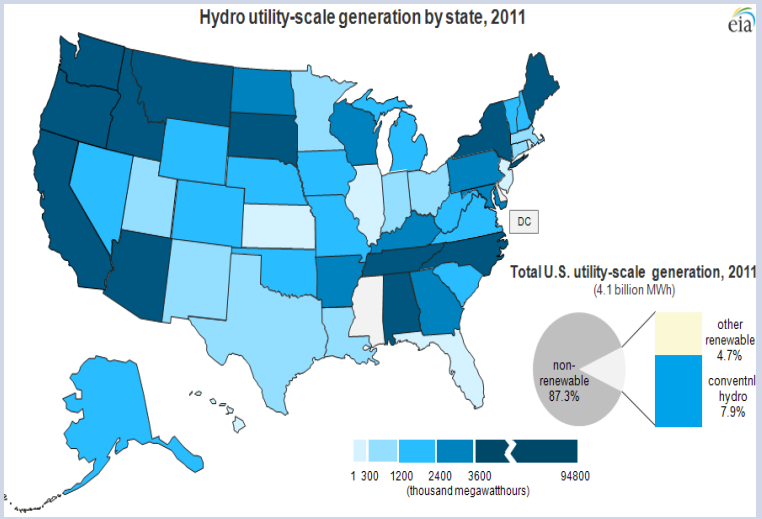
Ample Biomass Resources, but Biopower is Not Growing

Source: Union of Concerned Scientists, 2012



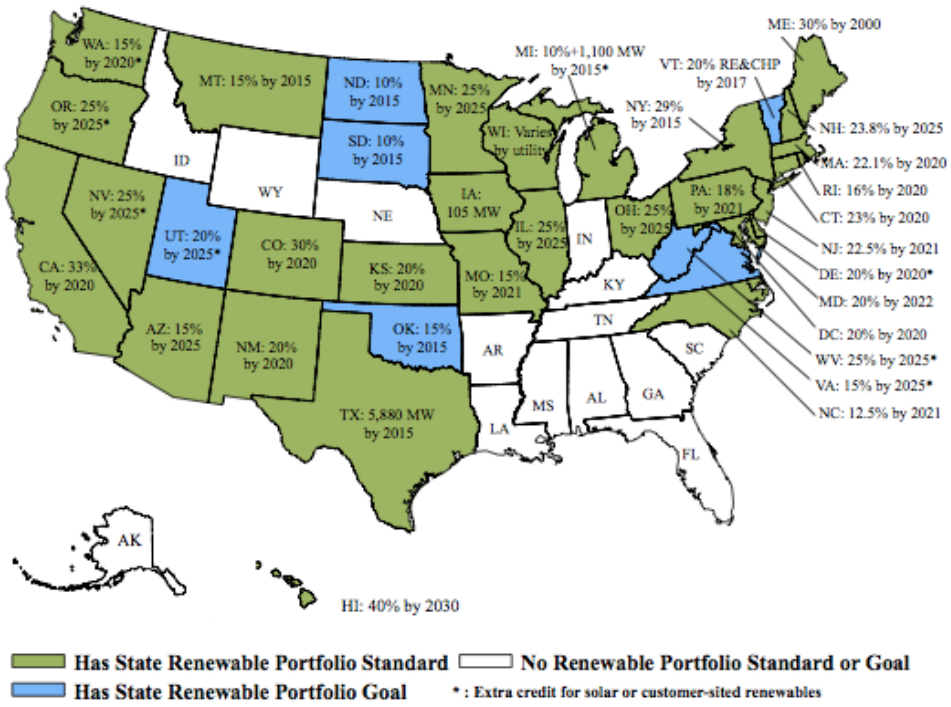
Hydropower: Low-Cost Baseload Option with Some Expansion Opportunities

Source: EIA, 2012



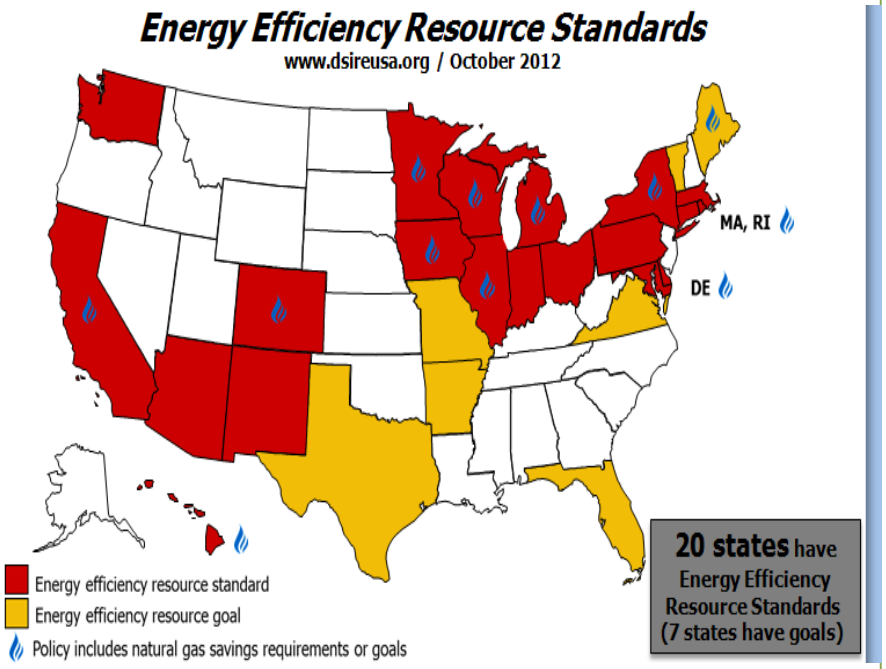
Few Southern States have Strong Renewable or Energy Efficiency Policies

9 Southern States Do Not Have an RPS



RPS=Renewable Portfolio Standard

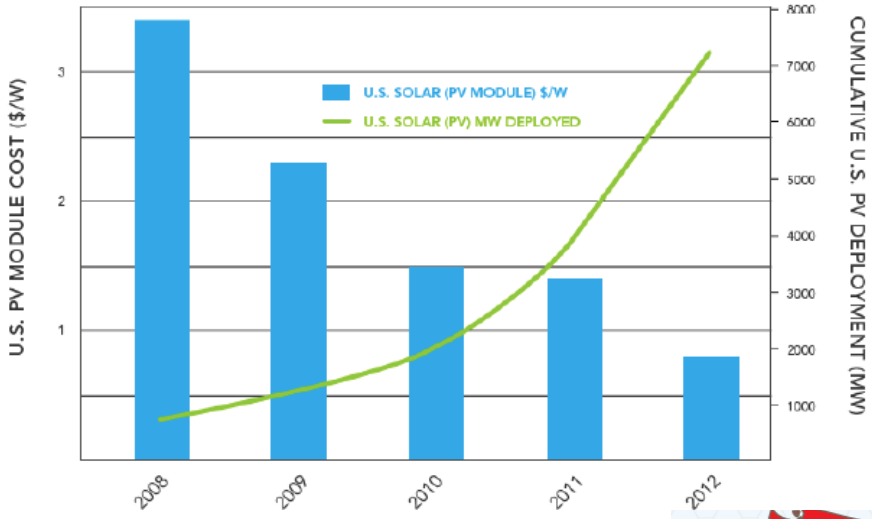
9 Southern States Do Not Have an EERS



EERS=Energy Efficiency Resource Standard

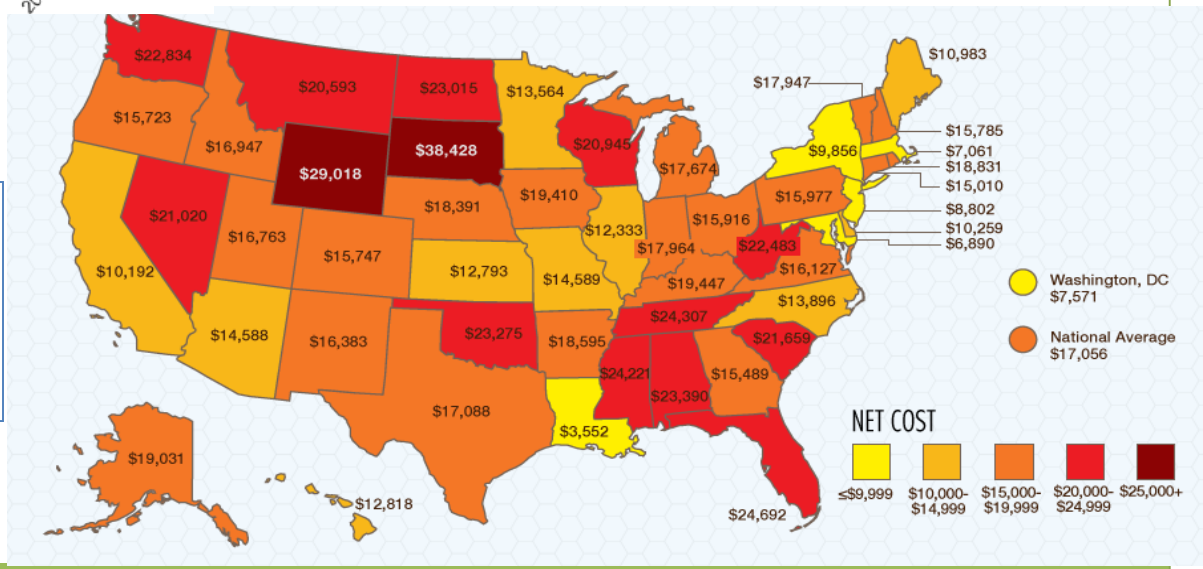
Source: DSIRE Database, http://www.dsireusa.org/

The Cost of Solar PV Has Been Declining Rapidly



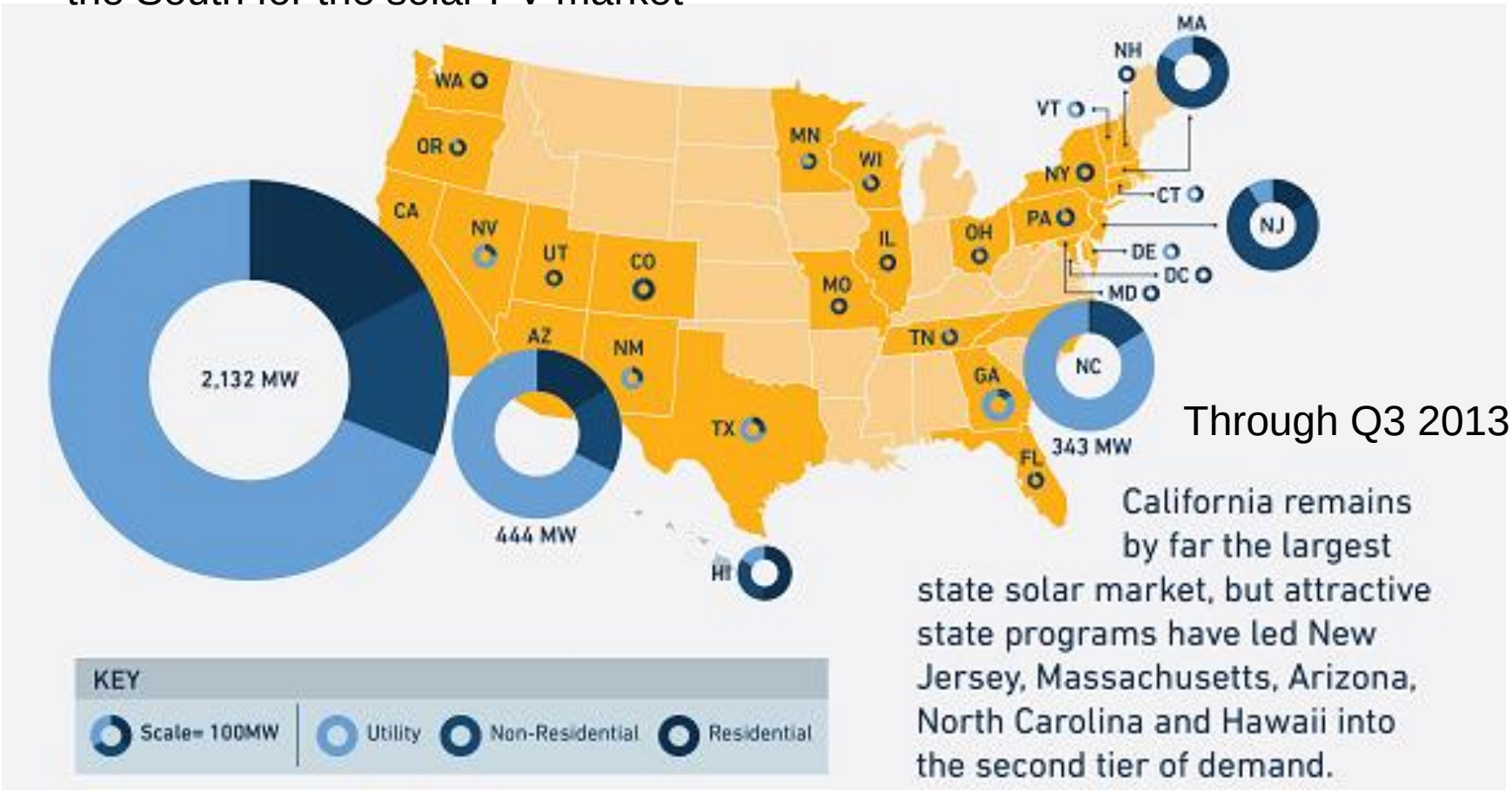
PV Module Costs are Declining Rapidly (Source: DOE. 2013. *Revolution Now)*

Residential Solar Costs in the South are Higher than the National Average (One Block Off the Grid, 2013,)



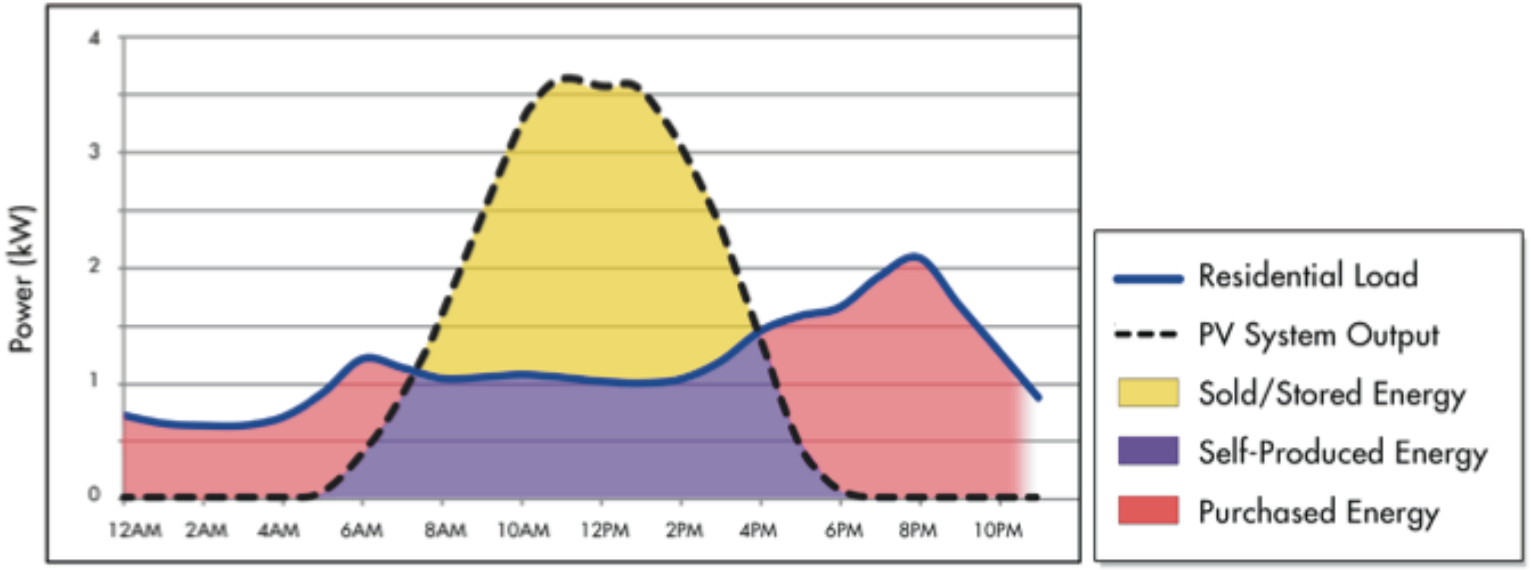
North Carolina and Georgia Lead the South's Effort in Installing Solar

- Georgia and North Carolina could signal the emergence of new opportunities in the South for the solar PV market



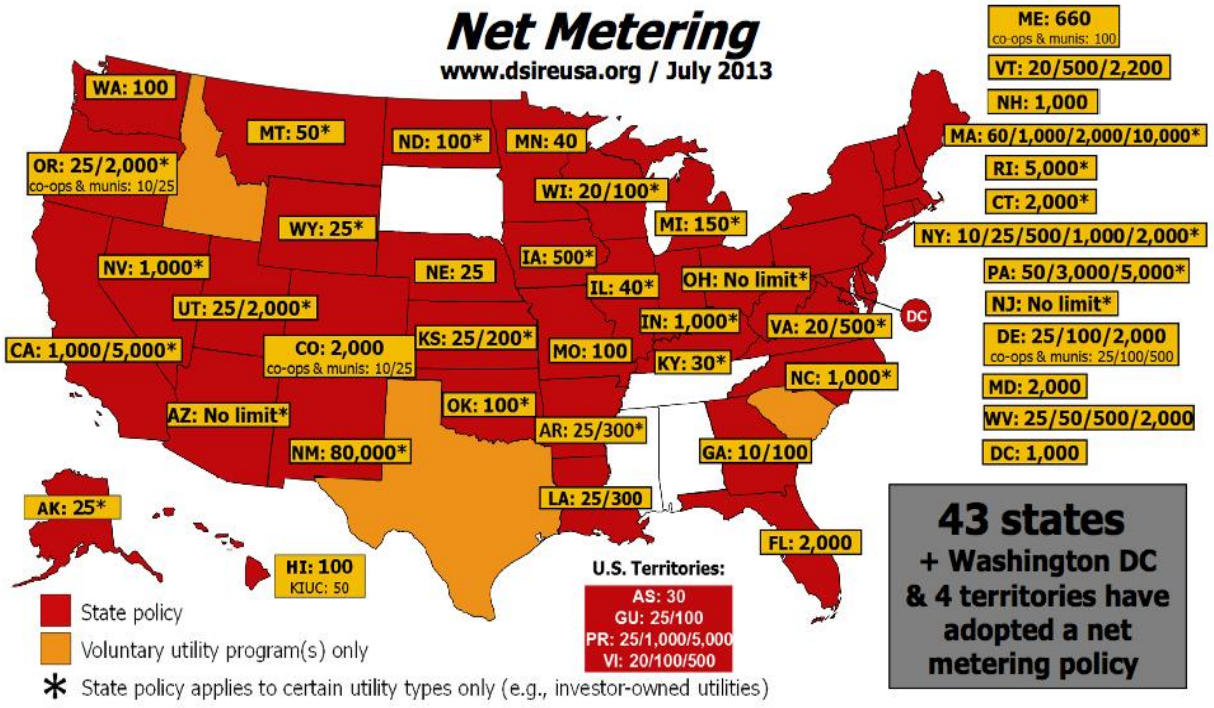
Source: Solar Energy Industry Association, http://www.greentechmedia.com/articles/read/Infographic-State-of-US-Solar-2013

Residential Load and PV System Output are not Coincident



Source: EPRI. 2014. *The Integrated Grid*

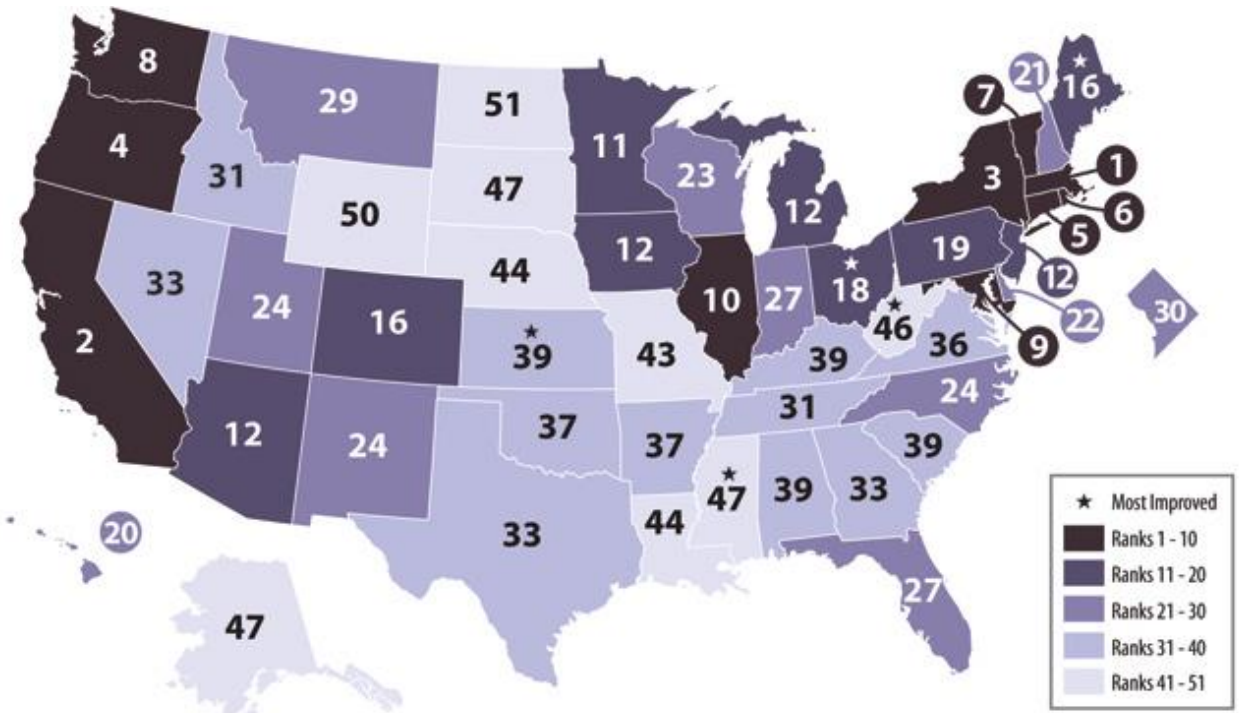
Net Metering Policies are Variable Across the South



Net Metering in the U.S. in 2013

(Numbers given are the maximum system size, in kW, residential/commercial/industrial)

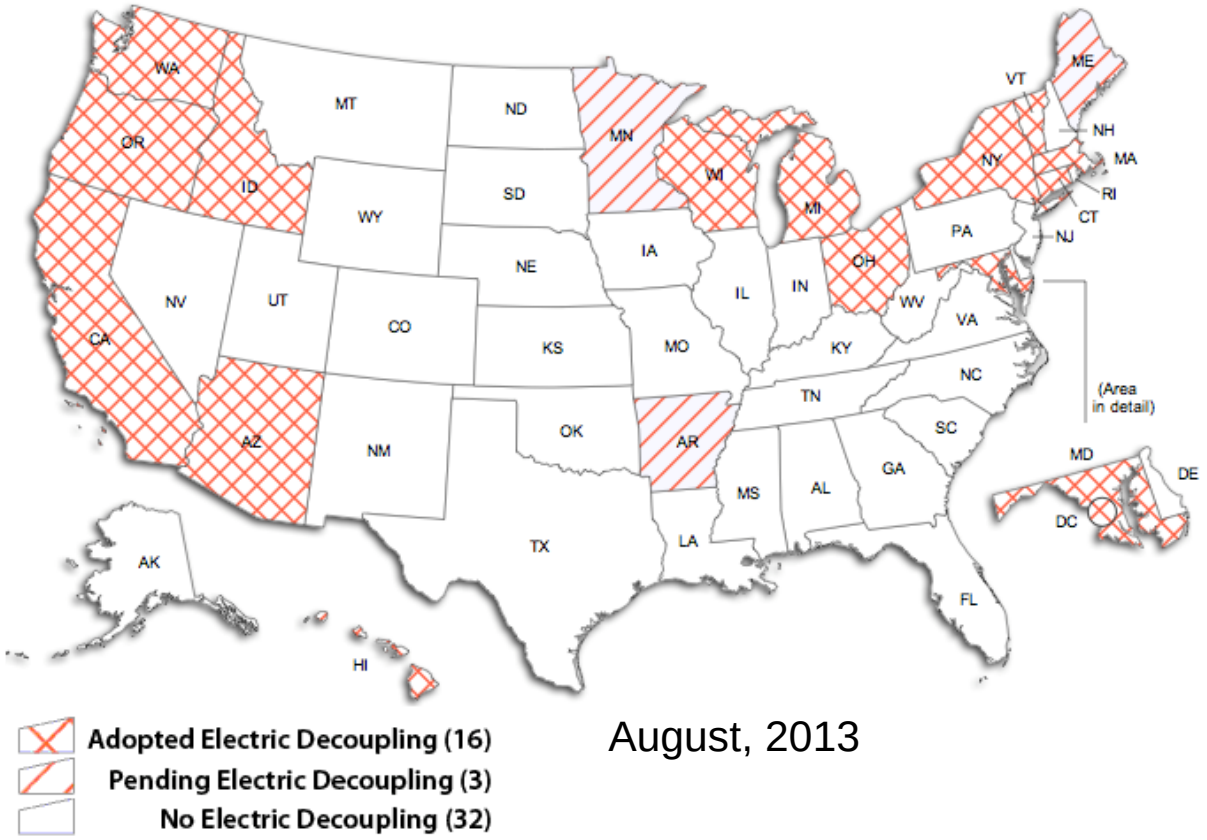
The South Lags in Energy Efficiency Performance and Policies, but is Improving



- Southern states rank consistently low in ACEEE's State Energy Efficiency Scorecards.
- In 2013, only North Carolina and Florida ranked in the top half.
- But several states have shown significant improvement in recent years.
- In particular, Mississippi was acknowledged for passing comprehensive energy legislation that included energy efficiency measures such as building energy codes for commercial buildings and public-owned buildings.

Source: ACEEE State Energy Efficinecy Scorecard Ranking, 2013

Electricity Decoupling Policies are Less Common in the South



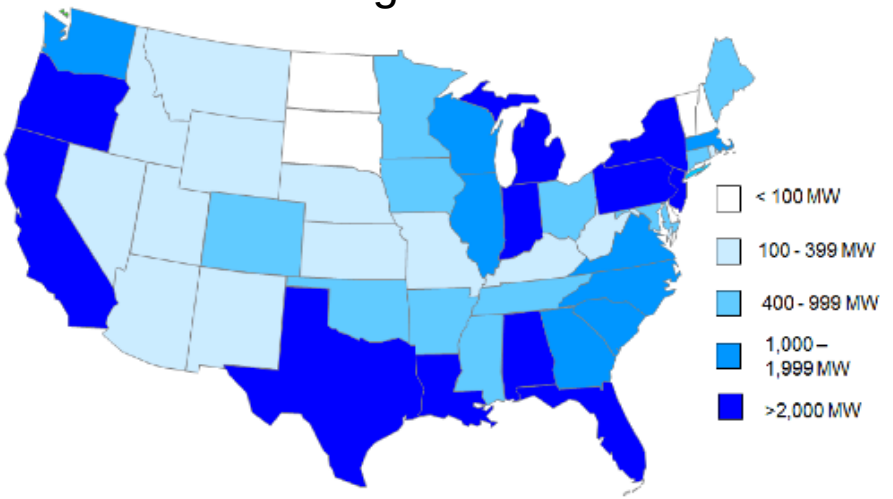
August, 2013

Generally, utilities recover fixed costs through consumption charges. Therefore, when sales fall, utilities may not recover all their fixed costs, resulting in a throughput incentive. Decoupling cost recovery and sales fixes this.

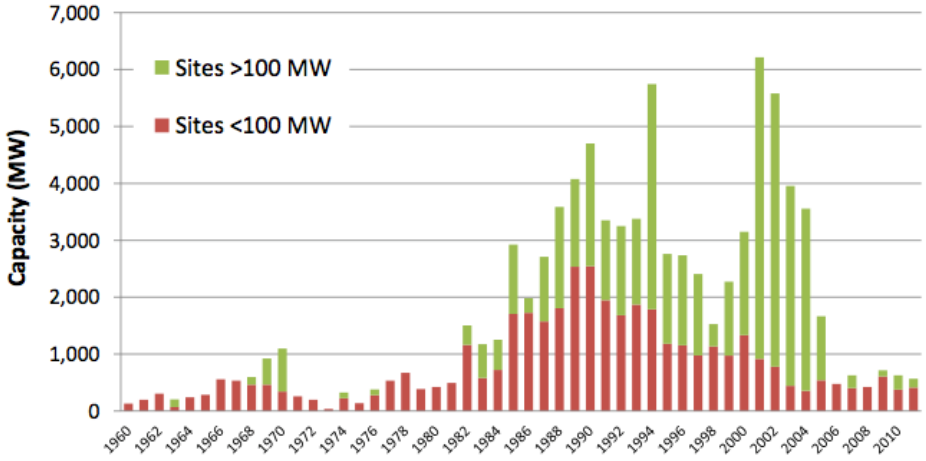
Source: Natural Resources Defense Council (NRDC) http://www.nrdc.org/energy/decoupling/

Combined Heat and Power as A Clean Energy Resource

Existing CHP

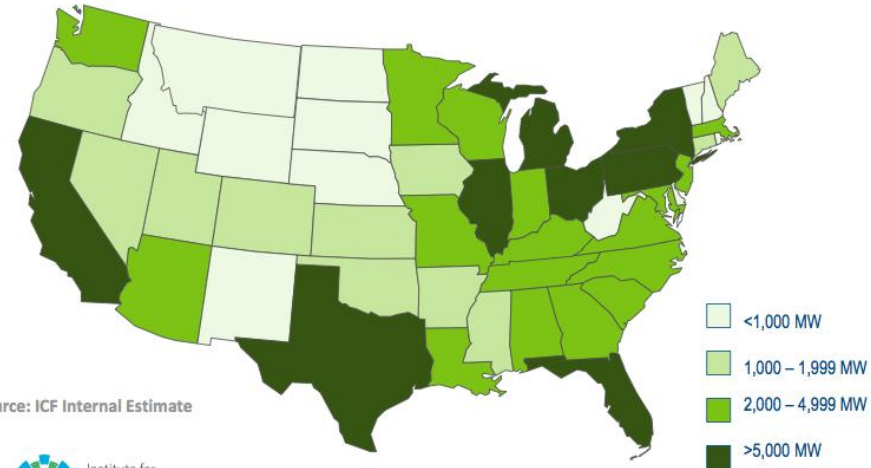


Annual CHP Additions, by Size



(Note the decline following the Energy Policy Act of 2005)

CHP Technical Potential

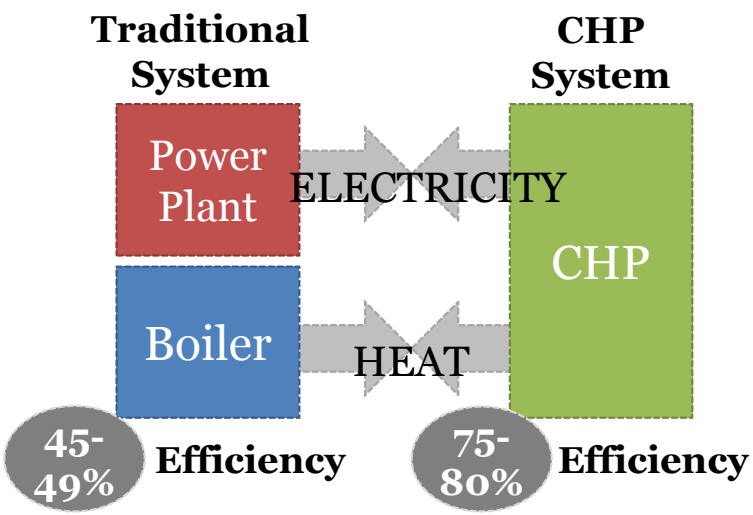


Source: ICF Internal Estimate

Institute for Industrial Productivity

| iipnetwork.org

Value Proposition for CHP



Source: Marilyn A. Brown, Matt Cox, and Paul Baer. 2013. “Reviving manufacturing with a federal cogeneration policy.” Energy Policy. 52 (2013) 264–276.

Value Proposition for CHP

Category	10 MW CHP	10 MW PV	10 MW Wind	Combined Cycle (10 MW Portion)
Annual Capacity Factor	85%	25%	34%	67%
Annual Electricity	74,446 MWh	21,900 MWh	29,784 MWh	58,692 MWh
Annual Useful Heat	103,417 MWh_t	None	None	None
Footprint Required	6,000 ft^2	1,740,000 ft^2	76,000 ft^2t	N/A
Capital Cost	$24 million	$60.5 million	$24.4 million	$10 million
Annual Energy Savings	343,747 MMBtu	225,640 MMBtu	306,871 MMBtu	156,708 MMBtu
Annual CO_2 Savings	44,114 Tons	20,254 Tons	27,546 Tons	27,023 Tons
Annual NOx Savings	86.9 Tons	26.8 Tons	36.4 Tons	59.2 Tons

Based on: 10 MW Gas Turbine CHP - 30% electric efficiency, 70% total efficiency, 15 PPM NOx

Source: Isaac Panzarella, Presentation at Georgia Tech Clean Energy Speakers Series, December 2013

CHP Installation Databae developed by ICF International for ORNL and DOE; 201. Available at http://www.eea-inc.com/chpdata/index.html and http://www.cogeneration.org/pdf/MCA2013April4_Hedman.pdf

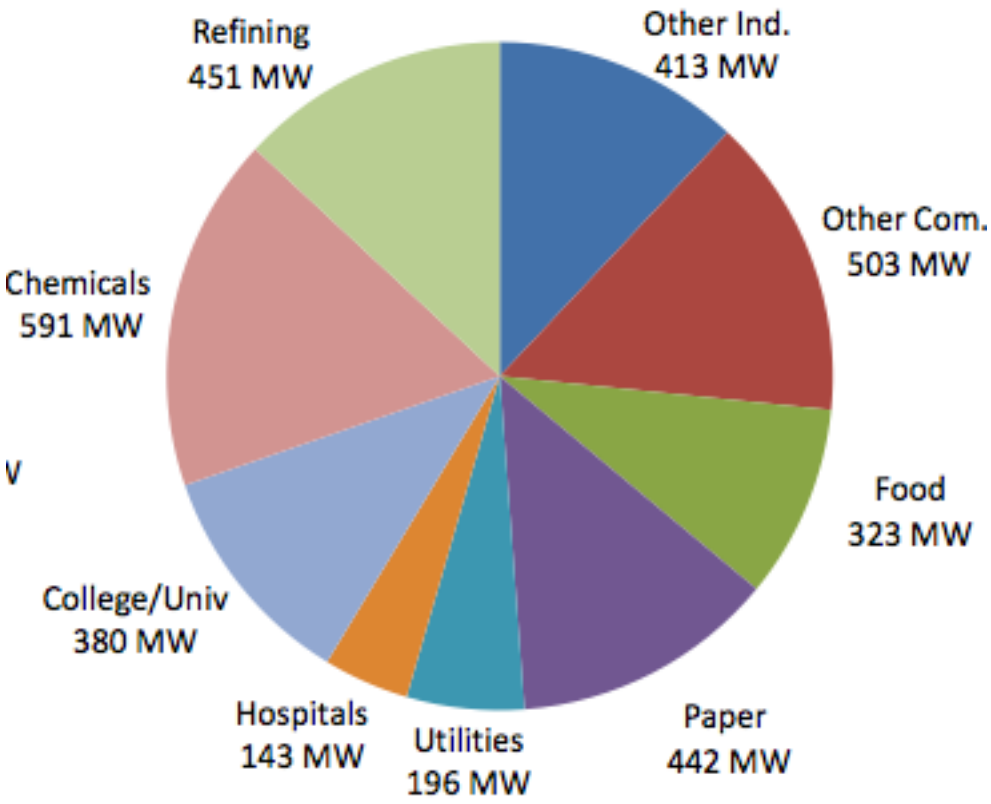
Remaining Potential for CHP

Remaining CHP Capacity in the South

	Existing Capacity (MW)		Remaining Potential (MW) <10 yrs payback
Alabama	3,217		416
Arkansas	493		-
Delaware	172		144
DC	14		-
Florida	3,380		2,202
Georgia	1,231		555
Kentucky	123		932
Louisiana	6,918		658
Maryland	714		306
Mississippi	514		274
North Carolin	1,541		632
Oklahoma	694		-
South Carolin	1,220		386
Tennessee	512		594
Texas	17,524		2,220
Virginia	1,732		490
West Virginia	382		244
Total, South	40,381		10,053

Source: ICF. 2013. *CHP Installation Database*

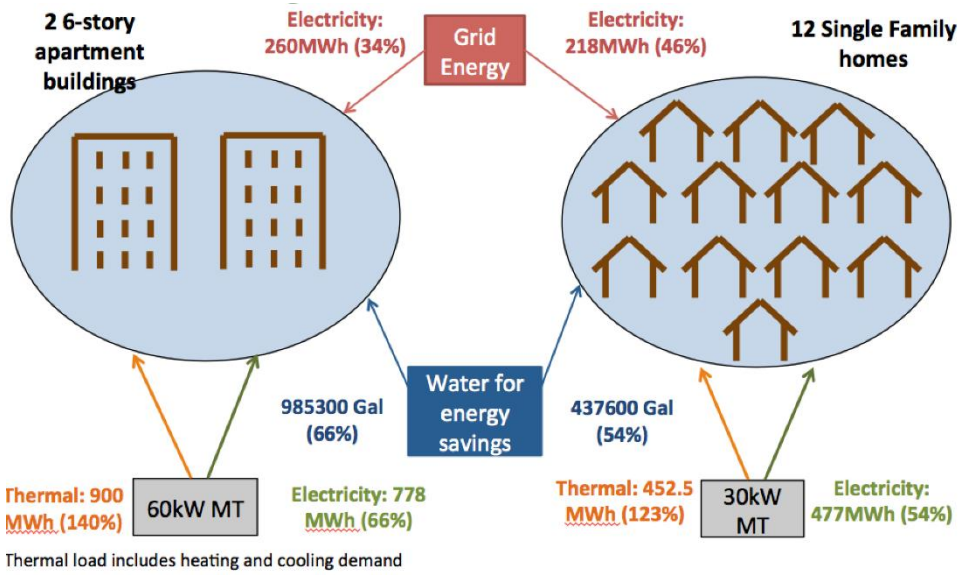
U.S. Existing CHP Capacity



Source: Bruce Hedman, April 2013. http://www.cogeneration.org/pdf/MCA2013April4_Hedman.pdf

Commercial CHP Potential in the South

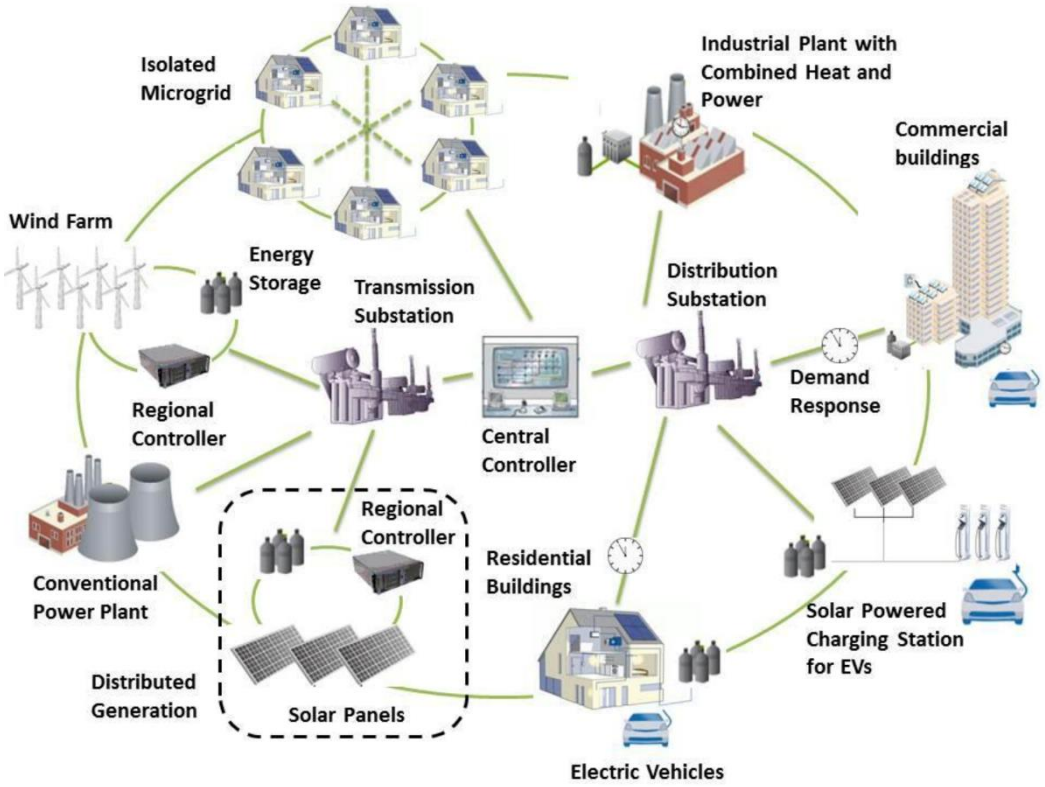
Building Energy Requirements Met by CHP Using Air Cooled Microturbines



Perkins & Will Office Building in Atlanta, with Rooftop CHP System

Source: John Crittenden et. al, Infrastructure Ecology: An Evolving Paradigm for Sustainable Urban Development, 2013 Presentation

Florida and North Carolina are the Leading Southern States in Smart Grid Investment



Concept of The Smart Grid

Source: Marilyn A. Brown and Shan Zhou, Smart-grid policies: An international review. Wiley Interdisciplinary Reviews: Energy and Environment, Vol 2 Issues 2, 2013

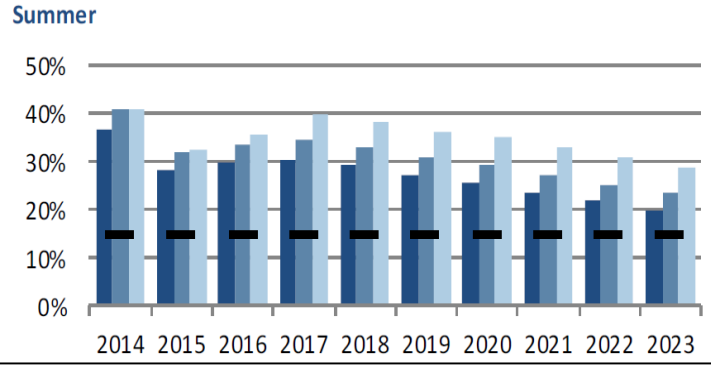
Operating Reserve Margins in SERC-SE are Solid, but Expected to Diminish Over Time

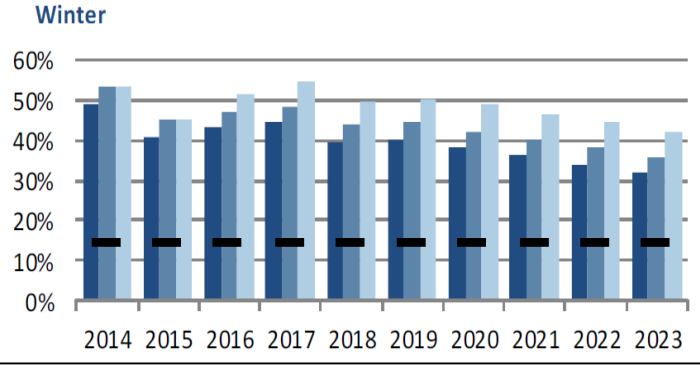
These trends are going against the anticipated increase of variable generation resources and increased use of demand response programs, both of which are expected to require planning reserve margins to sustain reliable operation of the system.

Planning Reserve Margins

SERC-SE-Summer		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
ANTICIPATED		36.76%	28.01%	29.73%	30.48%	29.09%	27.08%	25.47%	23.57%	21.67%	19.78%
PROSPECTIVE		40.78%	31.96%	33.61%	34.30%	32.88%	30.81%	29.14%	27.19%	25.24%	23.29%
ADJUSTED POTENTIAL		41.03%	32.20%	35.78%	39.80%	38.33%	36.19%	35.08%	33.04%	30.99%	28.96%
NERC REFERENCE	-	**14.99%**	**14.99%**	**14.99%**	**14.99%**	**14.99%**	**14.99%**	**14.99%**	**14.99%**	**14.99%**	**14.99%**

SERC-SE-Winter		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
ANTICIPATED		49.08%	40.76%	43.07%	44.29%	39.52%	40.19%	38.16%	36.11%	34.07%	32.05%
PROSPECTIVE		53.56%	45.18%	47.42%	48.61%	43.77%	44.38%	42.29%	40.18%	38.07%	36.00%
ADJUSTED POTENTIAL		53.72%	45.34%	51.41%	54.66%	49.74%	50.26%	48.76%	46.56%	44.36%	42.19%
NERC REFERENCE	-	**14.99%**	**14.99%**	**14.99%**	**14.99%**	**14.99%**	**14.99%**	**14.99%**	**14.99%**	**14.99%**	**14.99%**



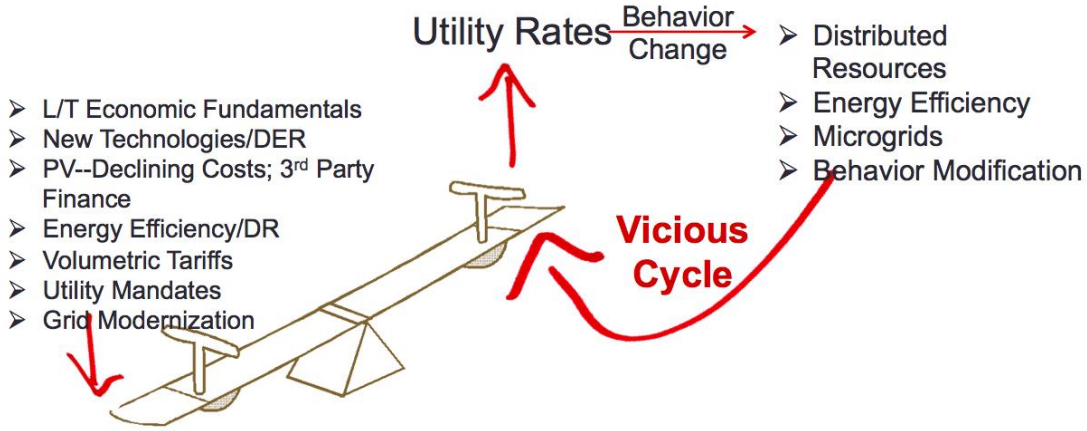


Source: NERC. 2013. Long Term Reliability Assessment Report

Disruptive Factors are Challenging Utility Business Models

Here's how the "vicious cycle" works:

- A suite of factors imposes upward pressure on utility rates.
- Consumers react to higher rates by using more energy efficiency measures, distributed resources like solar, etc.
- This reduces their energy demand from utilities and hence, imposes an even larger pressure for utilities to increase their rate to compensate for the loss in sales.



Source: Peter Kind. 2013.

What's at Stake for the South?

- The South has a unique opportunity to transform its power system
- It also has some of the biggest challenges
- Win-win policies exist
- The payback to getting it right is worth billions
- Success will require stakeholders to work together
- We want to chart a roadmap to help the South take advantage of this opportunity

Acknowledgments

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